

USER'S GUIDE

MC-24 MAINTENANCE CHARGER



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Items manufactured by companies other than Smith-Root carry the original manufacturer's warranty. Please contact product manufacturer for return instructions.

All Smith-Root, Inc. manufactured products are covered by a one year warranty.

Credit & Refund Policy: Customers returning equipment, in new condition, will be given credit within five days from the date of the return. A return authorization must accompany returns. Valid equipment returns include, but are not limited to, ordering incorrect equipment, funding deficits, and defective equipment returned for reimbursement. All returns are subject to a restocking fee and applicable shipping charges. The restocking fee is figured at 10% of the purchase price but not less than \$20.00. Customers receiving equipment in damaged condition will be referred to the shipping company for insurance reimbursement.

SPECIFICATIONS

MC-24 SPECIFICATIONS:

Input: 120/240VAC three-pin

Output Current: 250mA maximum per battery

Size and Weight:

Width: 6.375 in;

Height: 5.25 in;

Depth: 6.5 in

Weight: 5 lb.

The MC-24 Maintenance Charger Includes the Following:

Quantity	Description	Line #
1	MC-24 (US, Can, Japan)	#06811
4	Battery Cable	#07256

MC-24s sold outside of US, Canada and Japan (#09336) require the following power cords:

UK	Europe	Australia
#05575	#04807	#06066

The MC-24 Maintenance charger is designed for the care and maintenance of **lead-acid batteries only** and **is not intended for lithium batteries**. Failure to observe the proper use of the MC-24 may result in damage to the unit or batteries and could void warranty.

WARNING - Battery posts, terminals and related accessories contain lead compounds, chemicals known to the state of California to cause cancer and reproductive harm. Wash hands after handling.

DESCRIPTION

CHARGER DESCRIPTION

The MC-24 Maintenance Charger is specifically designed for proper battery maintenance and storage. Trickle charging optimizes battery shelf life by reducing cell deterioration.

Keeping batteries fully charged can greatly increase battery life. The MC-24 eliminates the hassle of shuffling batteries from shelf to charger, and keeps lead-batteries properly charged and ready for service. With the built-in battery evaluation load test function and maximum charge indicators, the operator can see the state of charge and condition of each



battery and identify low charged and worn-out batteries. Charging lead-batteries using the MC-24 takes between two and four days. It is also an excellent cost-effective alternative to purchasing multiple battery chargers because it can recharge four batteries at once (the MC-24 is NOT designed to maintain or charge lithium batteries).

CONTROLS

The MC-24 has two toggle switches marked POWER and LOAD TEST. The load test switch is a momentary switch to prevent accidental discharge of a battery. They are both located on the lower portion of the front panel.

CONNECTORS

There are five 2-pin connectors on the MC-24. Four of them, located on the lower portion of the front panel, are dedicated to maintenance charging. They are marked 1 through 4. The fifth, located on the right-hand side of the front panel - higher than the others - is dedicated to the battery testing. It is marked TEST BATTERY and is used exclusively for testing batteries under load.

There is also a connector marked BATTERY TEST VOLTAGE. This is used to connect a battery discharge fixture or for connecting a volt meter for testing.

MC-24 MAINTENANCE CHARGER

DESCRIPTION

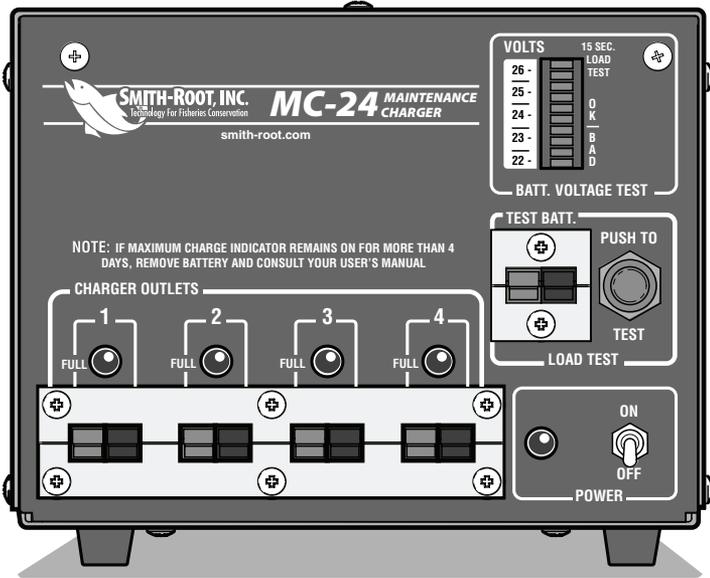


Figure 1. The MC-24 front panel

DISPLAYS

There are two independent displays on the MC-24 Maintenance Charger. The first consists of a line of four LEDs marked FULL. They show the charging functions of the MC-24. The second display is marked VOLTS. It is a ten-segment LED bar graph display. This display is normally linked to battery evaluation.

HOOKUP

The MC-24 is supplied with four 2-foot charging cables and a standard AC line cord.

Connect a charging cord from each battery to one of the connectors marked 1 through 4. Then plug the line cord into a standard AC wall receptacle or grounded extension cord.

After initial hookup, any of the four charging cables may be disconnected from its respective charger connector and moved to the BATTERY VOLTAGE TEST connector for an instant check on its condition. It must be replaced on its charger connector when the test is over.

OPERATION

CHARGER OPERATION

There are three different operations the MC-24 Maintenance Charger can perform:

- a. Battery maintenance
- b. Battery evaluation
- c. Emergency charging

BATTERY MAINTENANCE

Batteries undergoing maintenance charging should be in a cool place and left on the MC-24 continuously until needed. To place the batteries on maintenance charging, hook them up and then flip the POWER switch to ON. Note the state of the FULL LEDs. Initially, depending on the state of charge on each battery, these LEDs may be either on or off. An illuminated LED indicates that a battery has bumped up against the charger's internal current limiter, and there is nothing to worry about. If, however, an indicator remains illuminated for more than four days, there is reason for concern. It is most likely an old battery whose self-discharge rate has escalated to the point where the maintenance charger can no longer keep up, or else the battery has a shorted cell. In either case, the battery should be replaced.

BATTERY EVALUATION

It is a good idea to check the capacity of each battery before it is put away for any period. As a battery ages its capacity diminishes. An ailing battery placed

in storage for the winter will be of little use next spring. Recognizing a problem battery early allows you time to order a new battery for electrofishing season. The MC-24 Maintenance Charger incorporates an easy-to-use battery condition tester. Note that a battery must be fully charged before a load test is performed. To check a battery, simply plug its charging cables into the TEST BATTERY connector. If a battery has just been removed from a Charger (the standard UBC-24 or older BC-24PS), the BATTERY TEST READOUT should be approximately 27 volts. If the battery has had a 24-hour period in which to stabilize, the voltage should be around 24 volts. Depress the LOAD TEST button for 15 seconds. While the LOAD TEST switch is being held on, you should see the displayed voltage slowly decreasing as the test progresses. This is normal.

The voltage under load should stabilize somewhere within the area of the display marked LOAD TEST OK. If the voltage continues to decline during the test, it indicates that the battery requires either charging or replacement. A deep-cycle battery should be considered completely discharged when its voltage under the test load reaches 20 volts. Putting the battery in question back on a UBC-24 overnight and then repeating the test will determine if the battery

OPERATION

CHARGER OPERATION (CONT.)

needs replacing. Do not leave a battery connected to the TEST BATTERY plug if it is not currently under test. The metering circuitry will discharge the battery even if the LOAD TEST switch is not activated.

EMERGENCY CHARGING

It is common during electrofishing operations to have more batteries to recharge than there are chargers to service them. The MC-24 Maintenance Charger may be used to help fill this gap if extra time is available. The MC-24 will require between two and four days to restore a battery to full capacity, compared to the charger's 3 to 6 hours, but it will perform as well for four batteries as it does for one. This capability makes the MC-24 a valuable asset during the hectic periods often encountered during the electrofishing season.



Figure 2. A typical Battery



Figure 3. The UBC-24



The discontinued BC-24PS

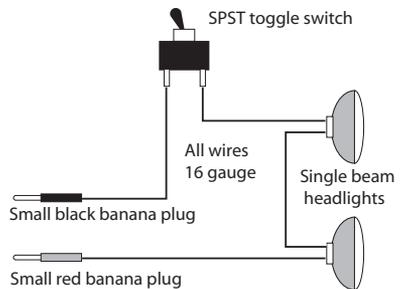


Figure 4. A Battery Discharge Fixture

RECHARGING

RECHARGING TACTICS

Recharging immediately after use will significantly increase the service life of the battery. It is recommended that the battery be recharged within 24 hours of being discharged.

RESISTING CHARGE

Delaying the recharge of even a partially discharged battery can make it resist the charger for some time. When put on a charger, the displays may indicate that the battery is fully charged, but when you attempt to use it again, it acts as if completely discharged. Resistance to charge is caused by sulfates deposited on the battery's plates crystallizing while in a discharged state. If a battery was placed in storage while in a partially discharged state, this resistance to charge will escalate. This can sometimes be corrected by using these tactics:

- a. Put the battery on a BC-24PS for several days to ensure that it has gone through a complete charging cycle.
- b. If the first method does not work, put the battery on a BC-24PS for a period of three weeks. After this charging period, do a discharge test with an Electrofisher, noting the amount of time the electrofisher operates before it shuts down. This operation time may increase appreciably with a few more normal charge-discharge cycles. The amount of capacity regained with each cycle will even-

tually level out, and this stabilization is an accurate indication of the battery's useful capacity.

BATTERY DISCHARGE FIXTURE

If the above methods do not work, make a Battery Discharge Fixture as shown in figure 4.

Hook up the ailing battery to the Battery Discharge Fixture. Leave the Fixture connected until the battery is flat. Note how long the discharge took. A battery should be considered completely discharged when it reaches 20 volts under load. Unplug the Battery Discharge Fixture and immediately connect the battery to the MC-24 and allow it to charge for three to four days.

Next, reconnect the Battery Discharge Fixture and repeat the discharge procedure, noting if the battery's capacity has increased.

If it has increased, repeat the charge-discharge cycle until the battery is restored. If the battery's capacity remains unchanged, try increasing the charge time. If the capacity decreases, it means the battery is at the end of its useful life and you must discard it.

MC-24 MAINTENANCE CHARGER

BATTERY CARE

ELECTRICAL CARE OF BATTERIES

Because the batteries supplied with the Electrofishers are of a special deep-cycle type, they need special electrical care. The following information will ease the task of maintaining batteries in peak condition.

DEEP-CYCLE BATTERIES

Deep-cycle battery technology came about to overcome the deficiencies of conventional lead acid automobile batteries. These starter batteries can de-

liver hundreds of amps for short periods of time, but to discharge them flat (as we commonly do with electrofishers) would significantly reduce the number of times they could be cycled. A conventional lead-acid automobile battery which is repetitively discharged to flat may have a life span of less than twenty-five cycles. To overcome this problem, battery manufacturers have developed plate alloys and designs to the point where we can recharge the latest generation of deep-cycle batteries over 1,000 times. These new batteries also feature a gel electrolyte instead of a liquid, so they can be operated in any position.

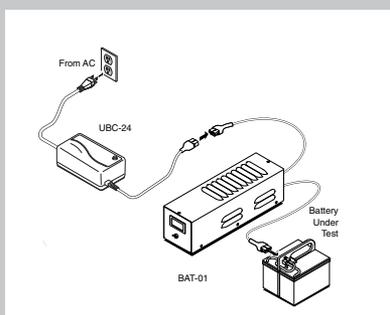
RATING

Batteries are rated at the current that will reduce the voltage per cell to 1.67 volts in 20 hours. The Electrofisher standard battery has a 12 amp hour rating. However, its capacity at 100 watts continuous would be only 150 minutes. See figure 5. As the discharge current is increased, the efficiency and relative capacity decrease.

Life	Load	Capacity
20 hr	0.60 A	12.0 Ah
10 hr	1.05 A	10.5 Ah
5 hr	1.95 A	9.7 Ah
1 hr	7.20 A	7.2 Ah
30 min	12.00 A	6.0 Ah
15 hr	20.00 A	5.0 Ah

Figure 5. Capacity of a battery under various loads

BAT-01 BATTERY ANALYSIS TOOL



The Battery Analysis Tool is an additional module designed to operate with existing Smith-Root batteries and chargers. Its purpose is to test back-pack Electrofisher batteries and to demonstrate in a clear, concise manner the amount of usable life remaining in batteries being tested.

BAT-01..... #08041

BATTERY CARE

SELF-DISCHARGE

All batteries exhibit self-discharge. The rate of self-discharge is determined mainly by age and storage temperature. The gel-electrolyte deep-cycle battery we supply with Electrofishers has a self-discharge rate between 3 and 6% per month.

This rate will vary with battery age and storage temperature. Figure 6 shows that higher temperatures produce higher self-discharge rates. The self discharge rate may exceed 3% per day when stored at elevated temperatures. This makes it necessary to recharge such batteries more often in order to maintain them at full capacity. Storage temperature above 20°C should be avoided. Shelf life can be increased by storing at lower temperatures.

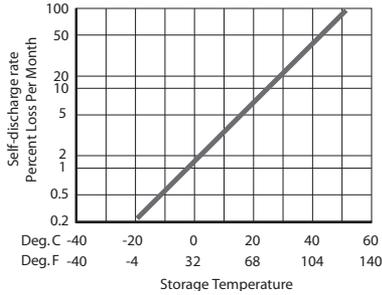


Figure 6. Self-discharge rate increased by heat

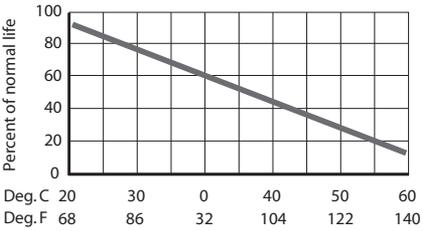


Figure 7. Life of battery reduced by heat

SERVICE LIFE

Figure 7 illustrates how high storage temperature reduces the service life of batteries. Store below 70°F if possible.

CAPACITY

Figure 8 shows that in very cold weather the battery will have less capacity, so the shocking time will be less.

Store above -30°C to prevent freezing.

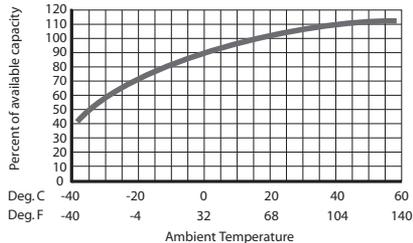


Figure 8. Capacity reduced by low temperature.

ELECTRICAL CARE OF BATTERIES CONT.

DISCHARGE RATE & TIME

Figure 9 shows the relationship

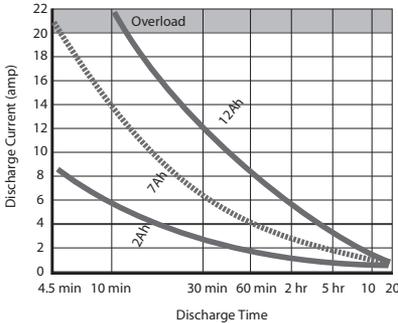


Figure 9. Shocking time reduced by high currents

between rate of discharge and electrofishing time available with the various batteries we supply. By associating the audio tone generated by an electrofisher's audible metering with a particular discharge rate, you can anticipate the shocking time available. By maintaining a modest 4 amp (100 watt) discharge rate, the shocking time will be adequate. Higher discharge rates will decrease the shocking time noticeably.

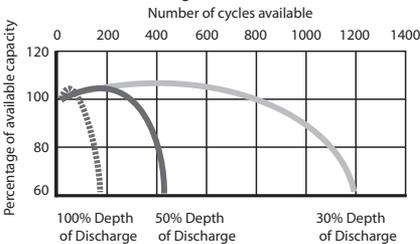


Figure 10. Life of battery reduced by depth of discharge

DEPTH OF DISCHARGE

Each time you cycle a battery it loses some of its ability to take a charge. The life of a deep-cycle battery is affected by the depth of discharge. A battery's useful life is over when it can no longer deliver 60% of its original capacity. Figure 10 shows that its useful life can be extended by reducing its depth of discharge. Although it is possible to obtain over 1000 cycles by limiting the depth of discharge to 30%, this limits its usefulness for electrofishing. A more practical strategy is to utilize a depth of discharge of somewhere about 50%. This offers an adequate shocking time, and a realistic number of charge-discharge cycles.

PHYSICAL CARE OF BATTERIES

A deep-cycle gel-electrolyte battery is composed of honeycomb plates of an alloy of lead and calcium packed with a lead paste. These plates are separated by layers of absorbent material containing just enough electrolyte. Any excess would only add weight and increase the opportunities for gases to build up around the plates and reduce the cell's capacity. This construction technique allows the battery to be placed in a smaller case and helps to prevent the

BATTERY CARE

battery plates from shorting out due to physical damage or improper maintenance procedures.

CASE DAMAGE

Case damage can usually be detected by a visual examination. Case damage allows electrolyte to be lost and/or contaminants to enter the battery. Any loss of electrolyte proportionately reduces the battery's capacity. Contaminants cause chemical changes that seriously reduce the battery's capacity, or cause it to fail.

VENT DAMAGE

When a conventional lead-acid battery is cycled normally, chemical changes cause some electrolyte to be converted into gasses. In sealed batteries, the case swells to accommodate these gases. In case of extreme abnormal conditions, relief vents prevent the pressure from bursting the case. These vents are one-way valves that allow the gases to escape but prevent foreign materials from entering the battery when the pressure drops again. If a vent is damaged, it will lose electrolyte in the form of gas and allow contaminants to enter the battery. Vent failure is rare and difficult to detect.

PLATE DAMAGE

Plate damage is the most difficult to detect because the case may show no evidence that damage has occurred within. Bent or dented plates compress the spongy material containing the electrolyte, which either depletes the electrolyte in that area, or shorts the plates together. The battery's capacity will be reduced, or it may fail.

PREVENTING DAMAGE

Ensure that batteries are protected from impact while being transported. A cardboard box lined with foam rubber, bubble wrap, or sheet Styrofoam is a cheap and effective insurance against physical damage. Leaving a battery strapped into an electrofisher while transporting it is better than no protection, but it invites mishaps.

SUMMARY

To increase battery life, follow these simple rules:

- *Store batteries in a cool place.*
- *Recharge batteries immediately after use.*
- *Keep batteries charged when not in use.*
- *Protect batteries from physical damage.*

OTHER SRI BATTERIES

CHARGING OTHER SMITH-ROOT BATTERIES

The MC-24 Maintenance Charger is designed to support Batteries for the LR-24 Electrofisher System. However, users that have an inventory of older style Smith-Root Electrofisher batteries can maintain them with the following adapters.

The Model 12 Adapter Cable (#07458) will allow you to charge Model 12 Batteries (#03298 & #02595) with the current model of BC-24PS.



LR-24 Adapter Cable #07459

Also, the LR-24 Adapter Cable (#07459) will allow you to charge LR-24 Batteries with our older, Model 12 style BC-24 Battery Charger (#04954) with a 4-pin connector.



Model 12 Adapter Cable... #07458



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